

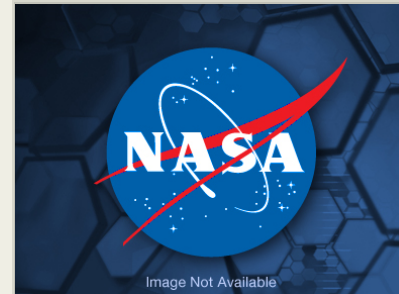
Science Flight Program of the Nuclear Compton Telescope

Completed Technology Project (2012 - 2018)



Project Introduction

This is the lead proposal for this program. We are proposing a 5-year program to perform the scientific flight program of the Nuclear Compton Telescope (NCT), consisting of a series of three (3) scientific balloon flights. NCT is a balloon-borne, wide-field telescope designed to survey the gamma-ray sky (0.2-5 MeV), performing high-resolution spectroscopy, wide-field imaging, and polarization measurements. NCT has been rebuilt as a ULDB payload under the current 2-year APRA grant. (In that proposal we stated our goal was to return at this point to propose the scientific flight program.) The NCT rebuild/upgrade is on budget and schedule to achieve flight-ready status in Fall 2013. Science: NCT will map the Galactic positron annihilation emission, shedding more light on the mysterious concentration of this emission uncovered by INTEGRAL. NCT will survey Galactic nucleosynthesis and the role of supernova and other stellar populations in the creation and evolution of the elements. NCT will map 26-Al and positron annihilation with unprecedented sensitivity and uniform exposure, perform the first mapping of 60-Fe, search for young, hidden supernova remnants through 44-Ti emission, and enable a host of other nuclear astrophysics studies. NCT will also study compact objects (in our Galaxy and AGN) and GRBs, providing novel measurements of polarization as well as detailed spectra and light curves. Design: NCT is an array of germanium gamma-ray detectors configured in a compact, wide-field Compton telescope configuration. The array is shielded on the sides and bottom by an active anticoincidence shield but is open to the 25% of the sky above for imaging, spectroscopy, and polarization measurements. The instrument is mounted on a zenith-pointed gondola, sweeping out ~50% of the sky each day. This instrument builds off the Compton telescope technique pioneered by COMPTEL on the Compton Gamma Ray Observatory. However, by utilizing modern germanium semiconductor strip detectors in a compact, shielded telescope configuration, NCT achieves two-orders-of-magnitude improvement in detection efficiency, a much wider field-of-view, and high spectral resolution. These capabilities are optimized for a wide-field survey of gamma-ray emission. The wide-field imaging and zenith-pointed mode relaxes requirements on pointing stability. NCT is designed for 100-day ULDB flights, compatible with CSBF's 18 MCF super-pressure balloon. Balloon Flights: We are proposing three (3) balloon flights. Since we do not anticipate the ULDB platform becoming available until 2016, the first flight is a 6-day LDB flight from Kiruna, Sweden in 2014 that focuses on polarization science (as well as testing our ULDB system in flight). The second and third flights would be 50- to 100-day UDLB flights from Wanaka, New Zealand in 2016 and 2018. The additional observing time provided by the ULDB platform will allow us to perform the nuclear science goals, as well as the GRB observations. NASA's SMD Science Plan (2010): 'How do matter, energy, space, and time behave under the extraordinarily diverse conditions of the cosmos?' NCT is designed to address this question by probing the origins of Galactic positrons, uncovering sites of nucleosynthesis in the Galaxy, and performing pioneering studies of gamma-ray polarization in a number of source classes.



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Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Responsible Program:

Astrophysics Research and Analysis

Project Management

Program Director:

Michael A Garcia

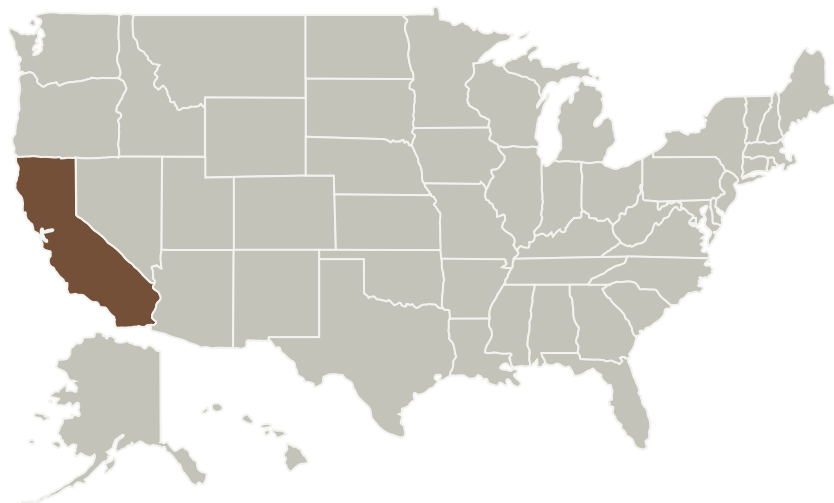
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Institut de Recherche en Astrophysique et Planetologie(IRAP)	Supporting Organization	Academia	Toulouse, Outside the United States, France
Lawrence Berkeley National Laboratory(LBNL)	Supporting Organization	R&D Center	Berkeley, California
National Tsing Hua University	Supporting Organization	Academia	Hsinchu, Outside the United States, China
University of California-Berkeley(Berkeley)	Supporting Organization	Academia	Berkeley, California

Project Management
(cont.)**Program Manager:**

Dominic J Benford

Principal Investigator:

Steven E Boggs

Co-Investigators:

Alan Chiu
 Hsiang-kuang Chang
 John A Tomsick
 Andreas Zoglauer
 Pierre Jean
 Mark Amman

Technology Areas

Primary:

- TX08 Sensors and Instruments
 - ↳ TX08.1 Remote Sensing Instruments/Sensors
 - ↳ TX08.1.1 Detectors and Focal Planes

Target Destination

Outside the Solar System



Primary U.S. Work Locations

California